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Isabgol Husk: A Herbal Remedy for Human Health

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ABSTRACT

The dietary fibers have positive effects on human health, both in the prevention and in treatment of chronic diseases. Isabgol husk (*Plantago ovata*) is a natural polymer of plant origin which is mainly composed of polysaccharide chain having (1>3) and (1>4)-ß– xylan system. It is used a bulk forming agent in constipation but due to some other beneficial effects; it can also be used in colorectal cancer, ulcerative colitis, hemorrhoids, diabetes, hypercholesterolemia etc. The present review represents the applicability of Isabgol husk for human ailments.

Key words: Isabgol husk, treated husk, hypercholesterolemia, ulcerative colitis

INTRODUCTION:

Isabgol husk (Psyllium), an indigenous natural dietary fiber, official in IP, BP and USP consisting of the epidermal and collapsed adjacent layers removed from the seeds of *Plantago ovata* Forsk. (*P. ispaghula* Roxb.), is particularly rich in alimentary fibres and mucilage. The husk mucilage is a clear, colorless gelling agent, able to increase in volume upon absorbing water up to 40 times its own weight. It consists of 85% water-soluble fiber; partly fermentable (*in vitro* 72 % unfermentable residues) and acts by hydration in the bowel. Made up of polysaccharides, it is popularly used as a bulk laxative [1, 2]. Biological experiments have confirmed its cytoprotective action [3]. Ispaghula is nominated in Iran as ESFARZEH, and used mainly for its emollient effect. In Iranian folk medicine, there is a report on its anti-diabetic effect [4].

CHEMICAL COMPOSITION OF ISABGOL HUSK:

Isabgol contains ~15% of non-polysaccharide material[5] and the remaining 85% appears to consist of a single polysaccharide comprising D-xylose (~62%), L-arabinose (~20%), L-rhamnose (~9%) and D- galactouronic acid (~9%) [5]. The sugars present and their approximate proportions were first determined by Laidlaw and Percival [6, 7]. Out of two polysaccharide fractions separated from the husk mucilage; one (eq.wt.700; uronic acid 20%) is soluble in cold water while another (eq.wt.4000; uronic acid 3%) is soluble in hot water [6]. The polysaccharide has a linear back bone of ß-D-xylose residues in the pyranose ring form and disaccharide side chains with terminal a-D-galactouronic acid linked to O-2- of a-L-rhamnose. All the three side chains are attached to either O-2 or O-3 of xylose in the polymer back bone. The back bone has both (1>3) and (1>4) -ß- linkages but their sequence and the distribution of side chains, have not yet been determined [5, 8]. Shandu et al.(1981) obtained the mucilage from plantago seed husk by extraction with alkali and concluded that the preparation, although polydisperse, represented a single species of polysaccharide, a highly branched acidic arabinoxylan [9]. Haque et al. (1993) observed that large fragments of plant cell wall material with sizes in the range of 1-2mm were clearly visible in photomicrograph and on hydration in toluidine blue, these swelled rapidly and the outline of the cells became indistinct. After dispersion to the 'weak gel' state, 20-30µ fibrillar strands were lilac red as expected for material composed predominantly of polysaccharide [10].

THERAPEUTIC INDICATIONS:

Isabgol husk is an herbal medicine and used [11]-

a) For the treatment of habitual constipation;

b) In conditions in which easy defecation with soft stools is desirable, e.g. in cases of painful defecation after rectal or anal surgery, anal fissures and hemorrhoids;

c) In patients to whom an increased daily fibre intake may be advisable e.g. as an adjuvant in constipation predominant irritable bowel syndrome, as an adjuvant to diet in hypercholesterolemia.

POSOLOGY:

Oral use: Daily dose-

Adolescents over 12 years of age, adults, elderly: 7 - 11 g in 1 - 3 doses.

Children from 6 to 12 years of age: Half to two-thirds of the adult dose (3 - 8 g) daily

CONTRAINDICATIONS:

Ispaghula husk is not to be used by patients with a sudden change in bowel habit that persists for more than 2 weeks, undiagnosed rectal bleeding and failure to defecate following the use of a laxative. Ispaghula husk is also not to be used by patients suffering from abnormal constrictions in the gastro-intestinal tract, with diseases of the oesophagus and cardia, potential or existing intestinal blockage (ileus), paralysis of the intestine or megacolon, and diabetes mellitus, which is difficult to regulate. Patients with known hypersensitivity to Ispaghula husk should not use Ispaghula husk preparations [12]. Also, it is not to be used by patients with fecal impaction and undiagnosed abdominal symptoms, abdominal pain, nausea and vomiting unless advised by a doctor because these symptoms can be signs of a potential or existing intestinal blockage (ileus) [13].

WARNING:

It is to be taken with at least 150 ml of water or other fluid. It may cause blockage of throat or oesophagus after swelling if not taken without adequate traditional use fluid. Intestinal obstruction may occur if an adequate fluid intake is not maintained. This product should not be taken in case of difficulty in swallowing or having any throat problems. If chest pain, vomiting, or difficulty in swallowing or breathing after taking this product is experienced, immediate medical attention may be required. The treatment of the debilitated patient requires medical supervision. The treatment of elderly patients should be supervised.

INTERACTIONS WITH OTHER MEDICINAL PRODUCTS AND OTHER FORMS OF INTERACTION:

Isabgol-containing products may delay gastric emptying time and reduce absorption of some drugs. For example, lithium, potassium-sparing diuretics such as spironolactone, carbamazepine, salicylates such as aspirin, tetracyclines, and itrofurantoin may have decreased absorption when taken with Isabgol husk [14, 15, 16]. Digoxin levels may also be affected [16]. It is advised that drugs should be taken at separate administration times from Isabgol husk to minimize potential interactions (preferably, one hour before or a few hours after taking Isabgol husk). If the product is taken together with meals in the case of insulin dependent diabetics, it may be necessary to reduce the insulin dose [17]. Although no effect on warfarin levels with co-administration of psyllium was reported in the study, administration of these agents should be separated until better research is available[16]. Due to potential reductions in blood sugar levels caused by psyllium, requirements for insulin or other diabetes drugs in diabetic patients may be reduced [18]. Blood glucose levels should be closely monitored and dosing adjustments may be necessary. Ispaghula husk should be used concomitantly with thyroid hormones only under medical supervision because the dose of the thyroid hormones may have to be adjusted [19, 20]. In order to decrease the risk of gastrointestinal obstruction (ileus), Ispaghula husk should only be used under medical supervision together with medicinal products known to inhibit the peristaltic movement (e.g. morphinomimetics, loperamide) [21]. Long-term use of psyllium can reduce absorption of iron, zinc, copper, magnesium and vitamin B_{12} [22]. Absorption of calcium may also be affected [23, 24]. One study in female rabbits showed that while guar gum reduced the absorption of ethinylestradiol, psyllium actually slightly increases the total absorption; however the absorption rate was slow [25]. Other agents should be taken one hour before or a few hours after psyllium to avoid potential interactions. Psyllium-containing products may delay gastric emptying time and reduce absorption of dietary carbohydrates [26].

UNDESIRABLE EFFECTS:

Flatulence may occur with the use of the product which generally disappears in the course of the treatment. Abdominal distension and risk of intestinal or oesophageal obstruction and fecal impaction, particularly if swallowed with insufficient fluid may occur due to the allergic potential of Ispaghula. Although rare patients must be aware of reactions of hypersensitivity including anaphylaxis-like reactions [2]. The powdered Psyllium seed is a potent allergen that can produce IgE-mediated hypersensitivity when inhaled by nurses dispensing psyllium to patients [28, 29, 30, 31] and in workers of pharmaceutical industries processing psyllium [32, 33].Overdose with Ispaghula husk may cause abdominal discomfort and flatulence and even intestinal obstruction. An adequate fluid intake should be maintained and management should be symptomatic. Obstruction of the gastrointestinal tract has been noted in numerous cases with psyllium-containing laxatives, particularly in individuals with previous bowel surgery or problems, and/or when the laxatives are mixed

with inadequate amounts of water [34]. Gastrointestinal side effects are generally mild and have not prompted discontinuation of psyllium in most clinical trials [29]. Flatulence (gas), bloating, diarrhea, and constipation although have been reported, they are less frequent compared to wheat bran therapy [34]. Psyllium-containing laxatives are considered class C-2 drugs in pregnancy, meaning that they appear to be safe in all three trimesters, although studies in pregnant humans and animals have not been done. Psyllium-containing products are considered class 1 (apparently safe) during breastfeeding.

PHARMACOLOGICAL PROPERTIES:

PHARMACODYNAMIC PROPERTIES:

Constipation: The pharmacological effects, gut motility and transit rate [35] can be modified by Ispaghula husk through mechanical stimulation of the gut wall depending on the increase in intestinal bulk by water and the decrease in viscosity of the luminal contents. When taken with a sufficient amount of liquid (at least 30 ml per 1-gm of husk), it produces an increased volume of intestinal contents due to its highly bulking properties and hence a stretch stimulus occurs which triggers defecation. At the same time the swollen mass of mucilage forms a lubricating layer which makes the transit of intestinal contents easier. Psyllium husks also significantly increases the level of stool moisture, as well as wet and dry stool weight [34].

Hypocholesterolemic Effect:

In mild to moderate hypercholesterolemia, a reduction of serum cholesterol by approximately 5% has been reported [36] but the exact mechanism by which psyllium husk brings about a reduction of cholesterol is not totally clear. Animal studies have shown that psyllium increases the activity of cholesterol-7-a-hydroxylase (the rate-limiting enzyme in bile acid synthesis also referred to as cytochrome 7A [CYP7A]) more than twice that of cellulose or oat bran, but less than cholestyramine [37]. In animals fed with a high-fat diet psyllium, increases the activity of cholesterol-7-a -hydroxylase and HMG-CoA- reductase [38]. This animal study also revealed that both pectin and psyllium reduced Apo B secretion and the LDL catabolic rates were 100-percent faster in animals fed psyllium. In a human study, psyllium lowered LDL cholesterol, decreased cholesterol absorption, and increased the fractional turn over of both chenodeoxycholic and cholic acids [39]. Sprecher et al (1993) demonstrated a 3.5% reduction in total cholesterol and a 5.1% reduction in LDL levels after consuming 5.1 grams of psyllium husk twice daily for eight weeks [40].

Soluble and insoluble psyllium fibres have their role in reducing total serum and LDL cholesterol and consequently reduce the risk of heart diseases [41].A few functional foods have been developed using psyllium as the bioactive component and marketed for reducing total serum and LDL cholesterol [42]. Yu et al. (2001) developed an enzymatic method to produce absorbing capacity and different gelling properties [43]. It is possible to deliver the required amount of soluble fibre in a single serving of cookies using the modified psyllium and satisfy the chain of cholesterol lowering benefit [42].Yu and Perret (2003) demonstrated the potential of preparing novel psyllium preparations with improved gelling and water absorbing properties using a solid state enzymatic method for commercial food application. This procedure requires simple equipment to remove moisture after inactivating the enzymes and generates no chemical wastes [43].

Hemorrhoids:

With the known benefit of psyllium for both constipation and loose stools, it is not surprising that it would also be of benefit for hemorrhoids. Fifty persons with internal bleeding hemorrhoids were given either a placebo of B vitamins or 11.6 grams of Metamucil® daily for 40 days. Individuals in the psyllium group had significant improvement in reduction of bleeding and a dramatic reduction. Bleeding was stopped after treatment in the psyllium group, while those in the control group experienced no difference [44].

Ulcerative Colitis:

Anaerobic fermentation of the soluble non-starch polysaccharides from psyllium seed results in the production of the short-chain fatty acids eg. acetate, propionate and butyrate in the intestine [45]. Psyllium husk contains only the epidermis of the seed, while the actual seed has a higher amount of fermentable fiber. Because of this fiber content, psyllium seed degrades more slowly than pectin and produces fairly large amounts of butyrate and acetate. Butyric acid exhibiting antineoplastic activity against colorectal cancer, is the preferred oxidative substrate for colonocytes, and may be helpful in the treatment of ulcerative colitis. In a study of colorectal cancer patients, those given 20 grams of psyllium seed daily for three months exhibited an average increase of butyric acid production of 42 percent, which decreased to pretreatment levels within two months of cessation of supplementation[45]. In an open label, randomized, multi-center trial of persons with ulcerative colitis, psyllium seed supplementation (10 grams twice daily) was as effective as mesalamine in maintaining remission [46].

Diabetes Mellitus:

The effect of psyllium husk was studied in 34 men with type 2 diabetes and hypercholesterolemia given either placebo or 5.1 g psyllium twice daily for eight weeks. Total

cholesterol was lower by 8.9 % and LDL by 1.0 %. In addition, the postprandial rise of glucose was significantly reduced [47].

Colorectal Cancer:

Dietary fibre is also thought to help prevent colorectal cancer which causes the deaths of 55000 people in the USA in 1995. It is thought that the fibre may attenuate its effects by reducing transit time, thereby causing a reduction in bile metabolism by the gut microflora, dilution of the bile acids by stool bulking, alteration of microbial bile acids metabolism due to fibre fermentation, reduction of the pH and production of short chains fatty acids, or by direct binding to the bile acids and hence preventing their metabolism [48]. It has been promulgated that it is the secondary bile acids, deoxycholate and lithocholate, and in particular their ratio that is responsible for promoting this cancer [49]. Ispaghula fibre has shown anticarcinogenic effects in rats [50].The ratio of lithocholic acid to deoxycholic acid [51] and the product of this with the bile acid concentration [52] have both been put forward as risk factor in colorectal cancer. Chaplin et al (2000) showed that the ratio of lithocholic to the deoxycholic acid tends to be reduced during treatment with ispaghula husk and there are also statistically significant reductions in the ratio of total lithocholic acids to deoxycholic acid multiplied by the total bile acid output. Ispaghula acts as a substrate for the colonic microflora [53]. Fibre fermentation reduces the 7-µ-dehydroxylase activity [49]. The reduction in the proportion secondary bile acids (deoxycholic acid and lithocholic acid) being formed and reabsorbed reduces the dehydrophobicity of the bile acids feeding back to the liver. This alters the balance between two pathways [54] involving the hepatic 7-µ-hydroxylation and blood vessel 27-hydroxylation of cholesterol, for the production of the primary bile acids (cholic acid and chenodeoxycholic acid) with consequential decrease in the relative amounts of chenodeoxycholic acid to cholic acid being produced. When these bile acids themselves 7-µ-dehydrooxylated in the colon, they produce a lower amount of lithocholic acid. As isolithocholic acid is made from lithocholic acid by the gut flora, any reduction in lithocholic acid is also expected to reduce isolithocholic acid. In addition, undigested dietary fibre increases stool bulk and its water-holding ability, thereby diluting the concentrations. Lithocholic acid strips the protective mucous layer, increases the proliferation of normally non-replicating mucosal surface cells [55], comutagenic in rats [52], caucuses DNA damage in human cell lines [56], stimulates carcinogen production in the microbial flora, inhibits the toxifying enzymes [57] and reduces the normal defense mechanism in the mucosa [58]. The level of lithocholic acid relative to the deoxycholic acid has been found to be raised above unity in the faeces of patients with large adenomas [59] and colorectal cancer [60, 61].

PHARMACOKINETIC PROPERTIES:

Absorption: The Isabgol husk hydrates and swells to form mucilage because it is only partially solublised. Less than 10 % of the mucilage gets hydrolyzed in the stomach where mainly free arabinose is well absorbed.

Progress of action: Ispaghula husk usually acts within 12 to 24 hours after single administration. Sometimes the maximum effect is not reached for 2 or 3 days.

Elimination: Human intestinal flora in the large intestine degrades the polysaccharides.

CONCLUSION:

Isabgol husk, a natural edible polymer has been reported to be used in hemorrhoids, constipation, diabetes, ulcerative colitis. Besides its traditional use in constipation, husk can lower down the abnormal LDL level up to the normal which is the causative factor for different problems eg. Hypercholesterolemia, hypertension, low body working efficiency etc. Also, it has shown its cancer protective effect in different studies. All of the therapeutic applications of Isabgol husk are with negligible side effects/ or adverse effects. But the benefits in certain cases as on reducing the glucose level are still controversial and has not been totally studied or appropriately shown in type II diabetes. Hence, advanced research is essentially required in different proposed mechanism of husk for human health.

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